PEACE/WILLISTON
FISH & WILDLIFE
COMPENSATION
PROGRAM

BC hydro

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COLUMBIA

A Reconnaissance Survey Of Doonan Lake, 1998

R. J. Zemlak
March 1999

PWFWCP Report No. 191

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

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Reconnaissance Lake Inventory
of
Doonan Lake
WSC: 234-8755-380-165-000
Waterbody Identifier: 00503PINE

Prepared by:

Peace/Williston Fish and Wildlife Compensation Program
1011 Fourth Avenue
Prince George, BC
V2L 3H9

Approved by:

Nick Baccante, Regional Fisheries Biologist

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Project Reference Information

MoELP Project Number	N/A
FRBC Project Number	N/A
FDIS Project Number	N/A
FRBC Region:	N/A
MELP Region:	Omineca/Peace
MELP District:	Peace Sub Region
FW Management Unit:	7-31
Fisheries Planning Unit:	N/A
DFO Sub-District	N/A
Forest Region:	Prince George Forest Region
Forest District:	Dawson Creek Forest District
Forest Licensee and Tenure #:	Chetwynd Forest Industries

Watershed Information

Watershed Group:	Pine River
Watershed Code:	234-8755-380-165-000
Waterbody Identifier:	00503PINE
UTM at Lake Outlet	10.518339.6156243
Order at Lake Outlet	2
Number of Tributaries	3
Drainage Area	5.896 km^2
Magnitude	3
Elevation	± 1,204m
NTS Map	93 O/10
TRIM Map	930.057
BEC Zone	ESSFwk2
Air Photos	30BCC97182:68-70

Lake Sampling Summary

Lake Survey Type	Primary (97 RIC Standards)
Water Surface Area	122,000 m^2
Max. Depth	9.7 m
Mean Depth	3.5 m
Secchi Depth	8.5 m
Volume	420,000 m^3
Area Above 6m Contour	93,000 m^2
Shoreline Perimeter	1,570 m
Lake Length	550 m
Number of Islands	0
Species Present in Lake	Barren of fish

105-02049/

Contractor Information

Project Manager:	*Name:*	Peace/Williston Fish and Wildlife Compensation Program
	Address:	1011 Fourth Avenue, Prince George, BC V2L 3H9
	Phone:	(250) 565 - 6135
Sub-contractor:	*Name:*	N/A
	Address:	
	Phone:	
Field crew:	*Names:*	R.J. Zemlak and A.R. Langston
Data Entry by:	*Names:*	R.J. Zemlak
Report prepared by:	*Name*	R.J. Zemlak
Report edited by:	*Name*	A.R. Langston
Bathymetric map prepared by:	*Name:*	BC Conservation Foundation
	Address:	Suite 202, Third Avenue, Prince George, BC
	Phone:	(250) 562 - 6684
GIS services:	*Company:*	BC Environment, Omineca Region, GIS Section
	Address:	1011 Fourth Avenue, Prince George, BC
	Phone:	(250) 565 - 4471
Winter Water Chemistry conducted by:	*Name:*	Zenon Environmental Labs
	Address:	8577 Commerce Court, Burnaby, BC
	Phone:	(604) 444 - 4808
Summer Water Chemistry conducted by:	*Name:*	Pacific Environmental Science Center
	Address:	2645 Dollarton Hwy., North Vancouver, BC
	Phone:	(604) 924 - 2500
Aging sample analysis by:	*Name:*	N/A (lake is barren)
	Address:	
	Phone:	
Genetic sample analysis by:	*Name:*	N/A (lake is barren)
	Address:	
	Phone:	
Voucher Species ID by:	*Name:*	N/A (lake is barren)
	Address:	
	Phone:	

Table of Contents

PROJECT REFERENCE INFORMATION ii
WATERSHED INFORMATION ii
LAKE SAMPLING SUMMARY ii
CONTRACTOR INFORMATION iii
LIST OF TABLES v
LIST OF FIGURES v
LIST OF APPENDICES v

1.0 INTRODUCTION 1

1.1 PROJECT SCOPE/OBJECTIVES 1
1.2 LOCATION 1
1.2.1 Access 1

2.0 RESOURCE INFORMATION 3

3.0 METHODS 3

4.0 RESULTS AND DISCUSSION 4

4.1 LOGISTICS 4
4.2 IMMEDIATE SHORELINE 4
4.3 SURROUNDING COUNTRY 5
4.4 SUMMARY OF DATA COLLECTION 5
4.4.1 Annotated Air Photo 5
4.4.2 Bathymetric Map 5
4.4.3 Lake and Stream Photographs 5
4.4.4 Limnology Summary 5
4.4.5 Fish Sampling Summary 8
4.5 FISH AGE, SIZE AND LIFE HISTORY 8
4.6 SIGNIFICANT FEATURES AND FISHERIES OBSERVATIONS 8
4.6.1 Fish and Fish Habitat 8
4.6.2 Habitat Concerns 9
4.6.2.1 Restoration and Rehabilitation Opportunities 9

APPENDICES .....

APPENDIX 1. WINTER DISSOLVED OXYGEN/TEMPERATURE PROFILE (FEBRUARY 20, 1990) .....
APPENDIX 2. WINTER WATER CHEMISTRY DATA (GENERAL), FEBRUARY 20, 1990 .....
APPENDIX 3. LAKE SURVEY FORM AND SITE CARDS .....
APPENDIX 4. ANNOTATED AIR PHOTO .....
APPENDIX 5. BATHYMETRIC MAP .....
APPENDIX 6. LAKE AND STREAM PHOTOS .....
APPENDIX 7. SUMMER WATER CHEMISTRY DATA (GENERAL AND METALS), JULY 15, 1998 .....
APPENDIX 8. FISH SAMPLING DETAILS .....
APPENDIX 9. TRIBUTARY DESCRIPTION DETAILS .....

List of Tables

Table 1. Sampling Summary for Doonan Lake

List of Figures

Figure 1. Location of Doonan Lake
Figure 2. Dissolved oxygen/temperature readings on July 15, 1998
Figure 3. Dissolved oxygen/temperature profile (July 15, 1998)

List of Appendices

Appendix 1. Winter dissolved oxygen /temperature profile (February 20, 1990)
Appendix 2. Winter water chemistry data (General), February 20, 1990
Appendix 3. Lake survey form and site cards
Appendix 4. Annotated air photo
Appendix 5. Bathymetric map
Appendix 6. Lake and stream photos
Appendix 7. Summer water chemistry data (General and Metals), July 15, 1998
Appendix 8. Fish sampling details
Appendix 9. Tributary description details

1.0 Introduction

1.1 Project scope/Objectives

Doonan Lake is a primary lake that was surveyed to identify if the lake was suitable for future fish introductions. Anecdotal information indicated that the lake was barren of all fish species. In order to reduce angling pressure on other native fish stocks within the area (Pine River), Doonan Lake could be stocked and provide additional angling opportunities for local residents. Special attention would be made towards identifying other enhancement potentials.

1.2 Location

Doonan Lake is located approximately 33 km northeast from the town of Mackenzie BC or 70 km west of the town of Chetwynd BC (Fig. 1).

1.2.1 Access

Directions from the Windy Point junction (Hwy. 97 and Hwy. 39) are as follows:

- From Highway 97 Intersection with Highway 39, drive 66.2 km north on Highway 97.
- Turn left onto the Callazon - Clearwater Creek Forest Service Road (two lane gravel road, two wheel drive).
- Cross the Pine River Bridge (0.3 km).
- Cross the BCR railway tracks (0.6 km).
- Drive another 5.7 km north and turn right onto Doonan - Rupert Forest Service Road (also listed as West Fraser's 1700 Road). This road is a narrow two lane gravel (single lane in some locations) two wheel drive pick up accessible road. Vehicles with high clearance are required as there are usually many large rocks on the road.
- Continue driving 4.8 km on the Doonan - Rupert F.S.R.
- Then turn left at the "Y" intersection.
- Cross the Doonan Creek outlet stream (4.9 km) about 100 m from the last "Y" intersection (there are two culverts here).
- Drive another 100 m (5.0 km) and turn right at a second "Y" intersection.
- Drive another 500 m (5.5 km) and cross an inlet stream to Doonan Lake (a wood bridge covered by gravel).
- At 5.6 km, there is an old skidder trail on the right (south) leading towards Doonan Lake. There is no vehicle access on this old skidder trail. The trail is 90 m long and then ends. From here, a small hiking trail leads southeast to the lake (70 m long).

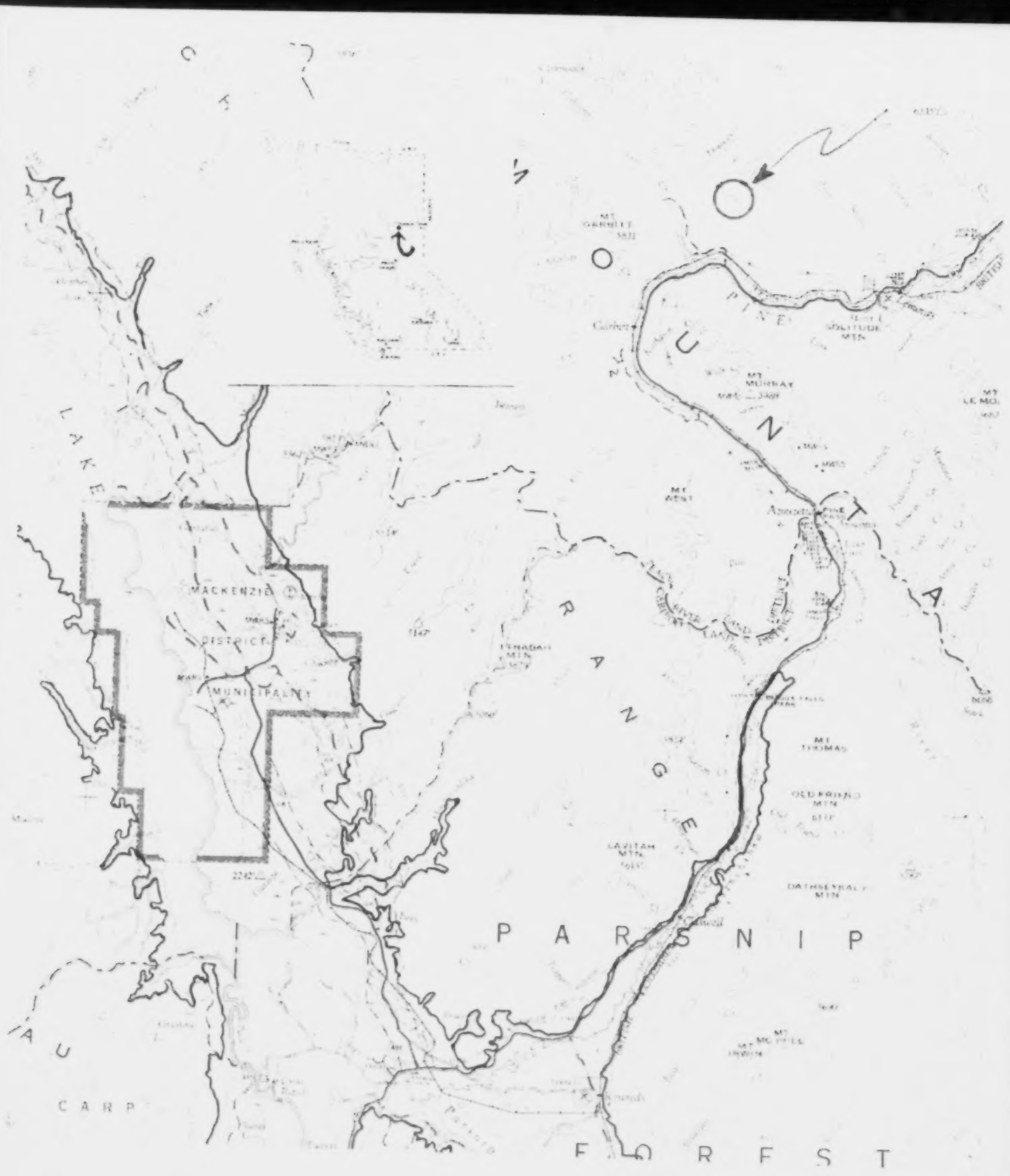

Figure 1. Location of Doonan Lake.

2.0 Resource Information

1. Land use development around Doonan Lake has mainly been forest harvesting and recreation use. The lake is presently forested around the shoreline but two clearcuts are visible from the lake while looking in the northeast and southwest directions. Hunters have hunted around the lake in the past. An old "stand" is present on the north shore.
2. The point of land on the southwest shore has been cleared of approximately 12 large coniferous trees and it is unknown why. There is no immediate access to this point of land. The trees have not been removed so timber harvesting is unlikely the purpose here. Also noted in this same area was a large spot on the ground (3 m by 3m) of what appeared to be fire retardant material. A lightning strike to this area may have occurred.
3. A natural underwater "spring" is located near the northeast shore.
4. The lake is used by many wildlife species. Wildlife species observed during this survey include: loons, Barrow's goldeneyes, a number of unidentified ducks, killdeers, sandpipers, sparrows, hummingbirds, and caribou.
5. Common aquatic insects include: scuds *(Gammarus* sp.), caddisflies *(Trichoptera* sp.), and the predaceous diving beetle *(Cybister* sp.)
6. A winter lake survey (dissolved oxygen and temperature profile) was performed on Doonan Lake during February 28, 1990 (Appendix 1). Water samples (general) were also collected and analysed by Zenon Environmental Labs (Appendix 2).
7. Lake drainage: Doonan Lake has 2 permanent inlets, 1 intermittent inlet, a natural underwater "spring", and one outlet. Site cards identifying specific habitat features were filled out for the lake itself, the two permanent inlets, and the one outlet (Appendix 3).

3.0 Methods

Below is a listing of all sampling equipment and methodologies used while conducting this lake inventory:

- Access to the lake was provided by a four wheel drive pick-up truck.
- A twelve foot aluminum boat with a 15 hp short-shaft outboard was used to obtain access out onto the lake.
- Air photo 30BCC97182 No. 69 was enlarged to make a lake outline for use in the field.
- Stream and habitat information was measured/recorded with the use of the following equipment: 1.5 m long staff gauge, 30 m eslon tape, clinometer, abney level, compass, 15 cm ruler, aquatic plant, tree, and aquatic insect identification books, Nikon FM2 camera with a 28 to 70 mm zoom lens, and a field note book.
- Limnology equipment included a: Secchi disc, YSI model 58 oxygen/temperature meter, hand - held alcohol thermometer, digital pH pocket tester (pHep 2 Hanna Instrument), Hach H_2S field test kit, conductivity meter (HI 8733 Hanna Instruments), a Verticle alpha water bottle (Vandorn), 1 liter and 250 ml plastic water bottles.

- Water samples (1 liter) were collected at: the surface, mid - zone, and 1.3 meters above the bottom. These samples were analysed for inorganics. One sample (250 ml) taken at 0.5 m from the surface was analysed for metals (added 2 ml of nitric acid for preservative). All four samples were analysed by the Pacific Environmental Science Center.
- Fish sampling equipment included a sinking monofilament experimental gillnet (length = 91.4 m, width = 2.4 m) comprised of six panels, each of a different mesh size, and six Gee traps (minnow traps) baited with sardines.
- A Lowrance X-15 echosounder was used for bathymetric map determination, sounding speed of boat was estimated at 1.0 m/s.
- Benchmark was set 2.0 m above current lake level with a 25 cm spike spray painted orange.
- Other equipment brought on the project include: 1 m long fish measuring board, 50 lb. hand - held digital balance, 500 g electronic balance, hand held radios with forest service and BC Hydro repeater stations, hand - held GPS unit, angling gear (for catch per unit effort), dip nets, camping equipment, and a Level 1 first aid kit.

4.0 Results and Discussion

4.1 Logistics

No significant problems were encountered during this survey. The weather was quite cold and rainy which made data recording in the field difficult at times. As a result, the lake survey forms and site cards were re-written back at the camp in order to ensure readability of the forms at a later date. The water samples arrived at the lab within the maximum allowable time frame for analysis. No fish were captured, therefore, verification of voucher specimens was not required. No problems were encountered with the design of the bathymetric map. One possible concern could be with the summer oxygen readings. The summer dissolved oxygen readings increase from the surface to the mid-zone. The oxygen meter was sent away for testing and re-calibration prior to this inventory. Therefore, these oxygen readings are assumed correct and indicate that the lake is well mixed.

4.2 Immediate Shoreline

The terrain immediately surrounding Doonan Lake has a low to very low slope. The lake outlet flows in a northwest direction. The immediate shoreline perimeter of the lake is treed to lakes edge. The forest stand is mature with approximately 80 % coniferous trees. Dominant tree species include sub-alpine fir *(Abies lasiocarpa)* and white spruce *(Picea glauca)*. Less numerous are willow species *(Salix* sp.). Sedges extend into the lake and have been observed around most of the shoreline. There is a small marsh located at the northeast end of the lake and a large marsh located at the southeast end. A rock escarpment approximately 40 m long is present on the southwest shoreline. Boating access from the lake to shore is fair. The northwest and southeast shores are quite shallow (organic substrate) and the south shore contains rock outcrops which pose as boating hazards. Shoreline substrate

consists mainly of organics with cobble/boulder on the south shore. Lake bottom drops off gradually from shore.

4.3 Surrounding Country

Doonan Lake is located in the Hart Ranges of the Rocky Mountains. The continuous forest cover is mature and consists of mainly sub-alpine fir and white spruce. Although, two clearcuts are visible from the center of the lake. One clearcut is located at the northwest end while the second is located at the southeast end. Both clearcuts are located within 1 km of Doonan Lake. The lake is surrounded by a relatively low slope. The lake setting is in the valley floor. The lake basin genesis appears to be of the glacial scour lake form. The aspect of the lake is northwest. There is a large marsh located at the southeast end and acts as a catch basin for the surrounding area. The hillslope coupling is best described as been coupled. Simpson Lake is located approximately 2.5 km southeast of Doonan and the height of land between them separates the two drainage areas. Doonan lake is located in the ESSF wk2 biogeoclimatic zone.

4.4 Summary of Data Collection

4.4.1 Annotated Air Photo

Air photo 30BCC97182 No. 69 (1 : 15,645) was enlarged (1 : 4,694) to make a lake outline for use in the field (Appendix 4). This photo indicates the locations of photographs, netting sites, minnow traps, direction of water flow, limnological station, and the benchmark.

4.4.2 Bathymetric Map

Eleven transects were conducted to create a bathymetric map (Appendix 5) for Doonan Lake. In addition, 19 spot sounds were conducted in the shallow zones of the lake where running the boat and motor was impossible. Transects were performed approximately 50 m apart.

4.4.3 Lake and Stream Photographs

Approximately 60 photographs were taken of the surrounding area of Doonan Lake (Appendix 6). Only a select few photos are presented in this report. The remaining photos not appearing in this report can be viewed at the Peace/Williston address presented at the beginning of this report.

4.4.4 Limnology Summary

- The general water sample analysis for inorganics examined 12 specific parameters (Appendix 7). The analyses were conducted by the Pacific Environmental Science Center.

- The water sample analysis for metals examined 29 specific parameters (Appendix 7). The analyses were also conducted by the Pacific Environmental Science Center.
- Metalimnion location appears to start between the 5.0 m and 5.5 m depth.
- Trophic level classification appears to be between ultra oligotrophic and meso trophic. When using total phosphorous as an indicator of trophic state, the surface (< 2 µg/l) and mid water (3 µg/l) samples fall in the category of ultra oligotrophic while the bottom sample (11 µg/l) falls into the meso trophic classification (John Stockner, Eco - Logic LTD., pers. comm.).
- The amount of available habitat relative to water chemistry results appear to be high as no anoxic conditions were present at the time of this survey.

Field Conditions:

Date:	July 15, 1998		
Time:	1545 hrs	Air Temperature:	21°C
Wind Velocity:	5 km/hr	Wind Direction:	from the south
Cloud Cover:	9/10 o.c.	Surface Condition:	slight ripple
Secchi Disc:	8.5 m	Water Colour:	green

Water Sample Chemistry;

EMS Site No.: 232783

	Sampling Depths		
	Surface (0.5 m)	Middle (4.0 m)	Lower (8.0 m)
pH (field)	8.6	8.6	8.0
pH (lab)	8.37	8.35	7.86
Specific Conductance (field)	0.2 mS	0.24 mS	0.2 mS
Filterable Residue 105°C (lab)	110 mg/l	100 mg/l	140 mg/l
H_2S (field)	0.0 mg/l	did not sample	0.0 mg/l

Bottom Depth:	9.3 m
Substrate Sample Depth:	N/A

Note: No H_2S smell detected in the lower water sample.

Summer Dissolved Oxygen/Temperature Data

Depth (m)	Oxygen (mg/l)	Temperature (°C)
0.5	9.2	14.5
1.0	9.0	14.2
1.5	9.3	14.1
2.0	9.3	13.8
2.5	9.5	13.7
3.0	9.4	13.6
3.5	9.4	13.5
4.0	9.4	13.5
4.5	9.5	13.4
5.0	9.3	13.2
5.5	13.6	12.1
6.0	13.6	10.5
6.5	12.4	9.3
7.0	10.7	8.3
7.5	8.9	7.8
8.0	7.6	7.6
8.5	-	-
9.0	-	-
9.3	Lake	Bottom

Figure 2. Dissolved oxygen/temperature readings on July 15, 1998.

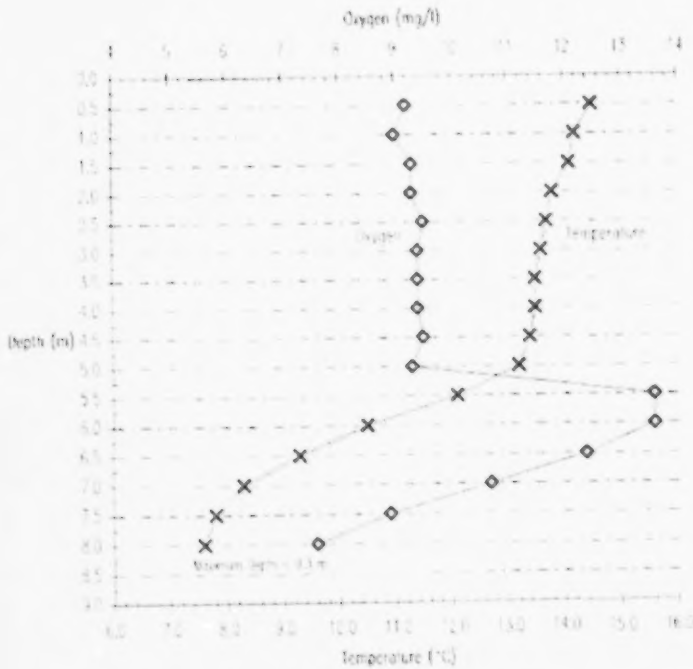

Figure 3. Dissolved oxygen/temperature profile (July 15, 1998).

4.4.5 Fish Sampling Summary

One sinking monofilament experimental gillnet (Appendix 4) was set for 19.6 hours (overnight). The net was checked periodically to prevent unnecessary fish mortalities. No fish were captured (Table 1, Appendix 8). Six minnow traps (Appendix 4) were set overnight for an average of nineteen hours. Again, no fish were captured (Table 1, Appendix 8). The gillnet was set on the northwest shore near the outlet. This area was selected since there was minimal debris near shore that the net would get caught up in and that the deep end panel could extend to a deep part of the lake. The maximum depth observed was 9.6 m and the deep end of the gill net was fishing up to 9.1 m in depth. The shoreline habitat consisted of a rock outcrop at shore. Depth of the lake dropped off fairly quickly at this point. The net was set almost perpendicular to shore.

Table 1. Fish sampling summary for Doonan Lake, July 13 - 15, 1998.

Fish Sampling Summary						
		Set		Pull		
Site No.	Method	Date	Time	Date	Time	Species
Site 1	Sinking Gill Net #1	July 13	5:45 PM	July 14	1:05 PM	none
Site 2	Minnow Trap # 1	July 13	5:55 PM	July 14	12:50 PM	none
Site 3	Minnow Trap #2	July 13	6:00 PM	July 14	12:55 PM	none
Site 4	Minnow Trap #3	July 13	6:05 PM	July 14	1:00 PM	none
Site 5	Minnow Trap #4	July 13	6:10 PM	July 14	12:35 PM	none
Site 6	Minnow Trap #5	July 13	6:15 PM	July 14	12:40 PM	none
Site 7	Minnow Trap #6	July 13	6:20 PM	July 14	12:45 PM	none

4.5 Fish Age, Size and Life History

No fish were captured or observed in the gill net or minnow traps. No fish were visually observed in the lake or inlets or the outlet. It appears that Doonan Lake is barren of all fish species; therefore, no fish data is presented.

4.6 Significant Features and Fisheries Observations

4.6.1 Fish and Fish Habitat

i. The entire shoreline of the lake was observed for sources of water input to the lake and for the lake outlet. Notes describing habitat features were taken for each permanent and intermittent stream (Appendix 9). Roads are present approximately one kilometer from the shoreline and allow travel along approximately 80 % of the perimeter (Appendix 5) of the lake. This road was traveled by vehicle to record all sources of water entering or leaving Doonan Lake.

ii. Spawning habitat in the main inlet stream (northeast end) and in the outlet is minimal for salmonids. Although Doonan Lake does not currently have any fish species, these streams (Appendix 4) should still

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Site 4	Minnow Trap #3	July 13	6:05 PM	July 14	1:00 PM	none
Site 5	Minnow Trap #4	July 13	6:10 PM	July 14	12:35 PM	none
Site 6	Minnow Trap #5	July 13	6:15 PM	July 14	12:40 PM	none
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ii. Spawning habitat in the main inlet stream (northeast end) and in the outlet is minimal for salmonids. Although Doonan Lake does not currently have any fish species, these streams (Appendix 4) should still

be protected for future possible fish use. Future fish introductions may be a viable enhancement option. The main inlet stream has developed a new channel approximately 125 m upstream from the mouth. The new channel is now flowing unconfined over the forest floor and contains no spawning substrate. The old channel does contain some spawning substrate and should be protected if future possible fish transplants were to occur. Protection of the main inlet and outlet streams at their respective road crossings should be considered to reduce silt introductions.

iii. A natural underwater spring is located at the southeast end of the lake.

iv. The benchmark was set near the outlet (near the right bank). The 25 cm iron spike was set 2.0 m above current lake level in a 22 cm diameter white spruce tree that is located 5.0 m from lake shore. High water mark indications are 0.2 m above current lake level.

v. The outlet stream has a road crossing on it 413 m downstream from the lake. The creek flows through two culverts at this point. At the time of this survey, the height in water drop was 30 cm into a small bedrock plunge pool. Four meters below this point is a waterfall measuring 0.5 meters in height. The creek was not surveyed further downstream of this point. This creek eventually flows into Doonan Creek. Given the areas steep topography, the outlet stream consists of numerous waterfalls/cascades. Some of these waterfalls are barriers to upstream fish passage. Therefore, fish can not access Doonan Lake from Doonan Creek. As a result, upstream passage at the road crossing culvert is currently not a concern. No fish will ever be able to access Doonan Lake unaided.

4.6.2 Habitat Concerns

4.6.2.1 Restoration and Rehabilitation Opportunities

i) Currently, Doonan Lake is barren of all fish species. Because of this fact, future watershed restoration projects on this lake may not be deemed a high priority. The inlet stream at the northwest shore has experienced a substantial amount of bed movement. With this bed movement, the creek has diverted away from it's natural channel and is now flowing unconfined on the forest floor. This change in channel morphology could be due to upstream impacts from past forest harvesting practices and road/bridge construction. There may be a resultant increase in the amount of flow the channel now has to sustain. Future enhancement activities would be to consider diverting the present channel back to it's original, more confined, channel.

Another point of concern on this stream would be to either upgrade the existing bridge or remove it. In the author's opinion, the bridge does not appear that it will be very

structurally sound in the future. The bridge is built out of a few large logs and is currently supporting a substantial amount of gravel to provide the road crossing. Should this bridge collapse, the creek will then be forced to create it's own channel once again and also add silt into the lake.

ii) Although Doonan Lake does not currently support a fish population, the survey results presented in this report indicate Doonan Lake is suitable for game fish introductions. The lake is deep enough (max. depth of 9.6 m) to support a population of fish throughout the year. At the time of this survey, the water column was well mixed with oxygen. A winter lake survey conducted in February of 1990 showed adequate oxygen levels (4.4 mg/L) to 4 m of depth (Appendix 1). The spring on the southeast end would also provide a source of oxygen for fish to survive throughout the winter.

The species of fish selected for introduction depends on the management goals for the lake and surrounding area. A recommendation would be to stock with native rainbow trout. This action would 1) provide additional angling opportunities in the immediate area, and 2) diversify or reduce the angling pressure on the native stocks in the Pine River and stocked brook trout population in Hart Lake. The area surrounding Doonan Lake does not have very many lakes where people can angle successfully for fish. Therefore, the Pine River and Hart Lake fish stocks, which are two areas that receive a lot of use from year to year, would be less impacted from anglers in the future.

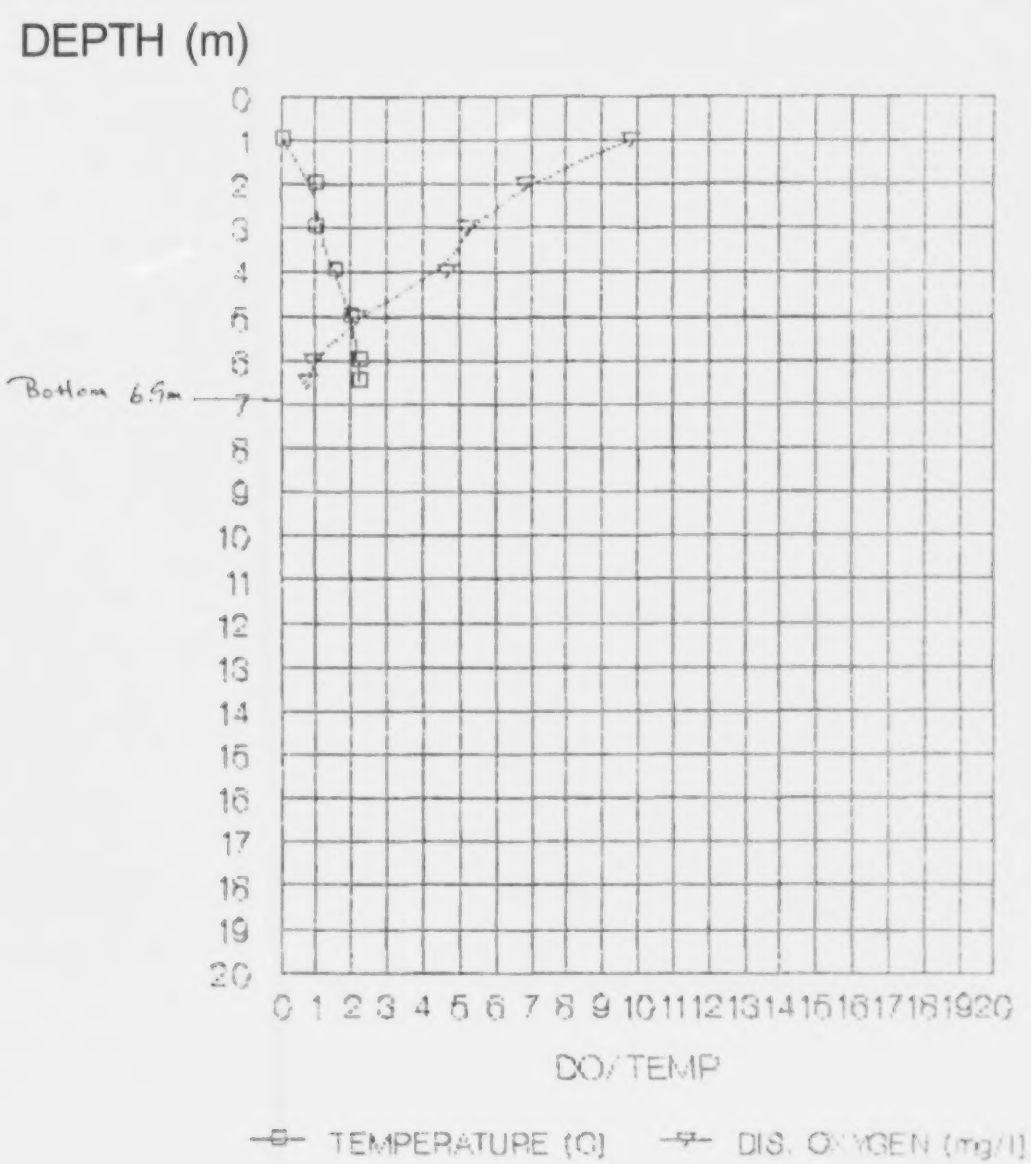
Since this lake flows into Doonan Creek and then on to the Pine River, hatchery stocks of fish may not be desirable. A more suitable donor source may be wild stock fish from Williston Reservoir. Fish could be removed alive from the intake towers at the WAC Bennett Dam in Hudson's Hope and transported to Doonan Lake.

If the goal of the stocking program was to produce a self sustaining population in Doonan Lake, the inlet stream at the northwest shore would have to be re-diverted back to its original channel. The present channel has a 1.0 m waterfall 20 m upstream from the mouth and affords no spawning substrate; whereas the old channel does contain some sparse amounts of spawning substrate. If the flow of this inlet could be contained, then spawning substrate could be added at a later date to provide additional spawning habitat for introduced rainbow trout.

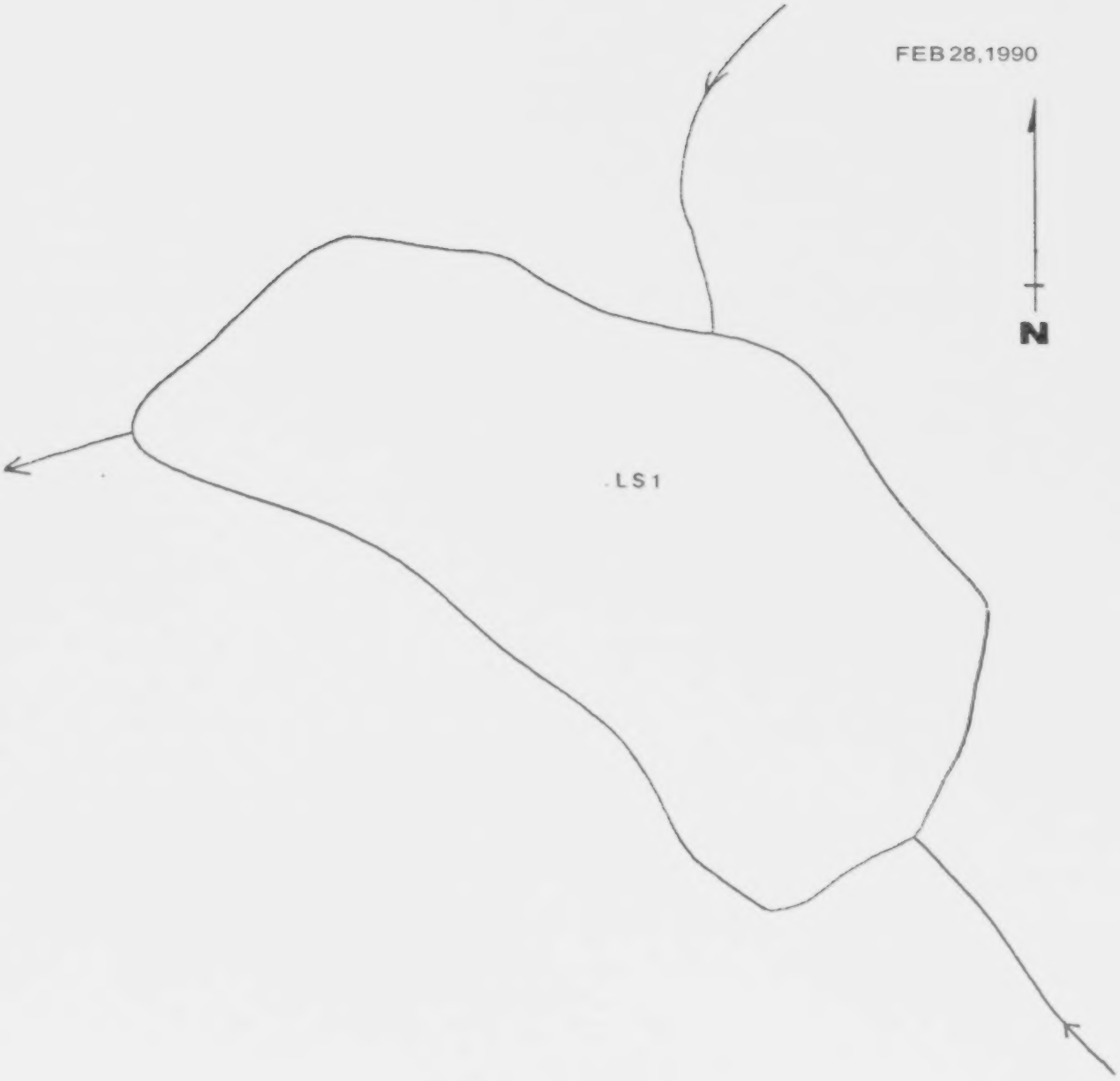
Appendix 1. Winter dissolved oxygen/temperature profile (February 20, 1990).

This data was collected by Ted Down and Ted Euchner, Fish Biologists with the Ministry of Environment, Lands and Parks, Fort St. John, BC.

DISSOLVED OXYGEN - TEMPERATURE RELATIONSHIP, "DOONAN" LAKE



FEB 28, 1990


FEB 28, 1990
N
LS1

Appendix 2. Winter water chemistry data (General), February 20, 1990.

This data was collected by Ted Down and Ted Euchner, Fish Biologists with the Ministry of Environment, Lands and Parks, Fort St. John, BC.

ZENON ENVIRONMENTAL INC.
B.C. LABORATORY SERVICES
Report for form 00420150
Resource Quality Sect.(RQ)-Water Prog ATTN: TED DOWN

Site: NOSITE "DOONAN" LAKE

Submitted by (10669) EUCHNER R B

Address (00) ENVIRONMENT & PARKS
10142 101ST AVENUE
FORT ST JOHN B C
V1J2B3

Phone No. 787-3294

Audit Sample ( )
Client study reference code (SD)
Sampling agency code ( )

Site (NOSITE) "DOONAN" LAKE

Sample Adjective ( )
Sample State (FW) Fresh Water
Sample Descriptor (GE) General

This form was processed to the computer on 6-MAR-1990 as REGULAR
The cost for analyzing samples for this form is

Routine analysis:	$	266.33
Special analysis:	$	49.32
Total	$	315.65

B C. LABORATORY SERVICES
Report for form 00420150
Resource Quality Sect (RQ)-Water Prog ATTN: TED DOWN Sample 89022088

Site: NOSITE "DOONAN" LAKE

From : 90/02/28: 1105 To : 90/02/28: 1105
Depth Range : 0.0 0.0 Tide :
Sample State: Fresh Water
Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Res. Filterable 1.0u	88	mg/L	Gravimetric 1.0u Filter (007H1032/02/36)
Nitrogen Kjel. Tot(N)	0.14	mg/L	Froz. Dig. Aut. Color (01132660/02/36)
Nitrogen Total	0.24	mg/L	Calculated Result (0114CALC/--/--)
Nitrogen NO3+NO2 Dis	0.10	mg/L	Froz. Aut. Cadmium Red'n (11092670/02/36)
Phosphorus Total	0.013	mg/L	Froz. Dig. Aut. Ascorbic Ac (P--T2710/02/36)
pH			Special Analysis (0004GSSP/02/36)
7.6 pH UNITS The cost of this special analysis was $	4.93		
Specific Conductance			Special Analysis (0011GSSP/02/36)
163 uS/CM The cost of this special analysis was $	7.40		

B.C. LABORATORY SERVICES
Report for form 00420150

Resource Quality Sect.(RQ)-Water Prog ATTN: TED DOWN Sample 89022089

Site: NOSITE "DOONAN" LAKE

From : 90/02/28:1110 To : 90/02/28:1110
Depth Range : 0.0 0.0 Tide :
Sample State: Fresh Water
Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Res Filterable 1.0u	140	mg/L	Gravimetric 1.0u Filter (007H1032/02/36)
Nitrogen Kjel.Tot(N)	0.14	mg/L	Froz.Dig.Aut.Color (01132660/02/36)
Nitrogen Total	0.25	mg/L	Calculated Result (0114CALC/--/--)
Nitrogen NO3+NO2 Dis	0.11	mg/L	Froz.Aut.Cadmium Red'n (11092670/02/36)
Phosphorus Total	0.010	mg/L	Froz.Dig.Aut.Ascorbic Ac (P--T2710/02/36)
pH			Special Analysis (0004GSSP/02/36)
8.0 pH UNITS The cost of this special analysis was $	4.93		
Specific Conductance			Special Analysis (0011GSSP/02/36)
250 uS/CM The cost of this special analysis was $	7.40		

B C. LABORATORY SERVICES
Report for form 00420150

Resource Quality Sect (RG)-Water Prog ATTN: TED DOWN Sample B9022090

Site: NOSITE "DOONAN" LAKE

From : 90/02/28: 1115 To : 90/02/28: 1115
Depth Range : 6.0 6.0 Tide .
Sample State: Fresh Water
Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Res. Filterable 1.0u	142	mg/L	Gravimetric 1.0u Filter (007H1032/02/36)
Nitrogen Kjel. Tot(N)	0.09	mg/L	Froz. Dig. Aut. Color (01132660/02/36)
Nitrogen Total	0.29	mg/L	Calculated Result (0114CALC/--/--)
Nitrogen NO3+NO2 Dis	0.20	mg/L	Froz. Aut. Cadmium Red'n (11092670/02/36)
Phosphorus Total	0.013	mg/L	Froz. Dig. Aut. Ascorbic Ac (P--T2710/02/36)
pH			Special Analysis (0004GSSP/02/36)
8.0 pH UNITS			
The cost of this special analysis was $	4.93		
Specific Conductance			Special Analysis (0011GSSP/02/36)
245 uS/CM			
The cost of this special analysis was $	7.40		

B.C. LABORATORY SERVICES
Report for form 00420150
Resource Quality Sect (RQ)-Water Prog ATTN: TED DOWN Sample 89022091

Site: NOSITE "DOONAN" LAKE

From : 90/02/28: 1120 To : 90/02/28: 1120
Depth Range : 6.0 6.0 Tide :
Sample State: Fresh Water
Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Res. Filterable 1.0u	88	mg/L	Gravimetric 1.0u Filter (007H1032/02/36)
Nitrogen Kjel.Tot(N)	0.09	mg/L	Froz.Dig.Aut.Color (01132660/02/36)
Nitrogen Total	0.27	mg/L	Calculated Result (0114CALC/--/--)
Nitrogen NO3+NO2 Dis	0.18	mg/L	Froz.Aut.Cadmium Red'n (11092670/02/36)
Phosphorus Total	0.014	mg/L	Froz.Dig.Aut.Ascorbic Ac (P--T2710/02/36)
pH			Special Analysis (0004GSSP/02/36)
7.7 pH UNITS The cost of this special analysis was $ 4.93			
Specific Conductance			Special Analysis (0011GSSP/02/36)
163 uS/CM The cost of this special analysis was $ 7.40			

Appendix 3. Lake surveyform and site cards.

LAKE SURVEY FORM

WATERBODY

WATERBODY TYPE: WETLAND 01 ☐ 02 ☐ 03 ☐ 04 ☐ 05 ☐ OR (LAKE) Primary ☒ Secondary ☐ | FISH COLLECTION FORMS ATTACHED? Y ☐ N ☒

LAKE NAME (GAZ): Poonam Lake | (LOCAL): Poonam Lake

WATERSHED CODE: 2 1 3 4 8 7 5 5 3 1 0 1 6 5 0 0 0 0 0 0

REACH #: unknown | AIR PHOTO REF: BCC A30162 #62-24 | REF COMMENTS: Colour, west facing

WATERBODY ID: 00503 PINE | ILP MAP #: N/A | ILP #: N/A | PROJECT ID: N/A | MAGNITUDE: 3

NID MAP #: N/A | NID #: N/A | UTM: 10 519339 6154243 | SURFACE AREA: 122,000 m² ha | SOURCE: BT

TRIM MAP #	YEAR	TRIM MAP #	YEAR
930.057	1988		

ELEVATION: 1204 m | SOURCE: NTS

BIOGEOCLIMATIC ZONE: AT SWB BWBS SBPS SBS MH (ESSF) BG PP IDF CDF ICH CWH MS

TERRAIN CHARACTERISTICS

NG (VF) VW MP PN PC | ASPECT: NW

HILLSLOPE COUPLING: DC PC (CO) | LAKE BASIN GENESIS: GL, GS

LAND USE	NO	AG	FB	FR	MI	PR	UD	OT
PERCENTAGE	30		60					10

SHORELINE CHARACTERISTICS

SHORELINE TYPE	I	II	III	IV	V
PERCENTAGE OF TYPE		10		30	60

COVER: NONE SPARSE (MODERATE) ABUNDANT

RECREATIONAL FEATURES: RESORTS ☐ CAMPSITES ☐ BOAT LAUNCH ☐

INLETS / OUTLETS

INLETS (PERM.): 2 | # INLETS (OTHER): | # OUTLETS: 1 | INLET (S) LAKES) SPAWNING HABITAT PRESENT Y ☐ N ☐

I/O	WATERSHED CODE	C	ILP MAP #	ILP #
O	2 1 3 4 8 7 5 5 3 1 0 1 6 5	(Outlet #)		
I	2 1 3 4 8 7 5 5 3 1 0 1 6 5 3 0 0	(Inlet #)		
I	2 1 3 4 8 7 5 5 3 1 0 1 6 5	(Inlet #)		

SURVEY INFORMATION

DATE: 1 9 9 3 0 7 1 3 to 1 9 9 3 0 7 1 5

AGENCY: C005 | CREW: RJS, ARL

ACCESS

AIR FW (H) | ROAD (V2) V3 | AUTO WITHIN: 160 m OF LAKE

OFF ROAD (FT) (ATV) V3 | DISTANCE: 160 km

TRAIL Y ☒ N ☐ | DISTANCE: 160 km

CLOSEST COMMUNITY: Chetwynd B.C.

COMMENTS: From Wild Rose Junction drive due W on Hwy 97 for 66.2 km. Turn left on to Gallagher Cr. Forestry Camp. F.S.R. 12 km gravel. Turn right @ 6.3 km on the West Pinto 1700 Rd. (Narrow 2 lane gravel). Stay left & 4 km. Stay right @ 5.0 km @ 5.6 km stay left to lake.

AQUATIC FLORA

EMERGENT VEG. SPARSE ☐ OR 20 % | SUBMERGENT VEG. SPARSE ☐ OR 40 %

DOMINANT SPECIES: i Sedge sp. | ii Equisetum sp. | iii Pondweed sp. | iv Sedge sp. | v Potamogeton sp.

DOMINANT SPECIES: i Potamogeton sp. | ii Equisetum sp. | iii | iv | v

FLOATING ALGAE PRESENT Y ☐ N ☒ | SPECIES LIST ATTACHED Y ☐ N ☒

NO. OF VOUCHER SPECIMENS COLLECTED (OPTIONAL): N/A

LAKE BATHYMETRY

TYPE OF SURVEY: FL EL SS NO | LITTORAL AREA: 70 %

MAX. DEPTH: 9.7 m | BENCHMARK ht: 2.0 m | MAX. WATER LEVEL: 2.2 m

BENCHMARK TYPE / LOCATION COMMENTS: 10" iron spike on top of orange cut limb in the NW corner of lake by the outlet. Approx. 20 m from the outlet. 5.0 m from the water. Surrounded by 22cm diameter white spruce trees.

PHOTO DOCUMENTATION

C	ROLL #	#	FOC LG	DIR	NID MAP #	NID #	UTM	mls	COMMENTS
	9	13	40	NW	—	—	10 518107 6156767	SPH	On outlet 20 m w/ Lake
	9	17	28	N	—	—	10 518560 6156760	SPH	On inlet, from the north end
	9	18	28	NW	—	—	10 518337 6156755	MAP	
	10	12	28	S	—	—	10 518775 6156603	MAP	
	10	13	70	SE	—	—	10 518975 6156653	MAP	
	10	17	28	SE	—	—	10 518977 6156767	MAP	
	11	3	32	S	—	—	10 519755 6156771	SPH	
	11	18	90	NE	—	—	10 519933 6156515	MAP	
	11	21	30	NW	—	—	10 518718 6156744	SPH	

Figure A3-1. Lake Survey form (front)

AQUATIC WILDLIFE OBSERVATIONS

GROUP	SPECIES / COMMENTS
BIR	1 Loon
BIR	2 unidentified ducks
BIR	6 Barrow's goldeneye
BIR	6 Ruddy duck
BIR	20 unidentified ducks
BIR	? Sandpipers
BIR	? hummingbirds

WEATHER COMMENTS

Aug 12 - 100% cloud cover, rain. Very cold
Aug 14 - 100% overcast, slight rain - ground
no rain until day. Very cold 7 8°C
Aug 15 - 90% cloud cover, slight wind from
the South

COMMENTS (SPECIFIC / GENERAL)

1 YSI model 58 O2 / temp meter used
2 2 Hach 2 Hanna Instruments used
3 Hach H_2S field kit used
4 HI8733 Hanna Instrument
conductivity meter used, temp.
coefficient = 2.0 > auto calibrates
for conductivity at 25°C.
5 O2 readings were taken when
sending probe down & temp. readings taken when pulling probe up
6 YSI model 58 was sent in to a certified lab for testing to ensure correct O2 temp readings & months prior to this survey. Meter not used prior to this survey after lab verification.

LIMNOLOGICAL STATION WATER QUALITY

STATION NO. 1 | DATE 19 08 21 / 15 | TIME 15:45
LOCATION UTM 10 519432 6565944 | EMS NO E236782

SECCHI DEPTH	3.5 m
WATER COLOUR	Green
FIELD pH (surface/bottom)	8.6 / 8.0
ice depth	N/A m

WATER SAMPLE

DEPTH (m)	REGISTRATION #
General	5001268 3
Metals	5001268 7

DISSOLVED OXYGEN, TEMPERATURE PROFILE AND CONDUCTIVITY

DEPTH (m)	▼ DO mg/L	▼ T °C	▲ DO mg/L	▲ T °C	C µmhos/cm	DEPTH (m)	▼ DO mg/L	▼ T °C	▲ DO mg/L	▲ T °C	C µmhos/cm
0.5	9.2	-	-	17.5	0.2	→ 5					
1.0	9.0	-	-	17.2							
1.5	9.2	-	-	17.1							
2.0	9.3	-	-	13.9							
2.5	9.5	-	-	13.7							
3.0	9.4	-	-	13.6							
3.5	9.4	-	-	13.5							
4.0	9.4	-	-	13.5	0.2						
4.5	9.5	-	-	13.4							
5.0	9.2	-	-	13.2							
5.5	13.0	-	-	12.1							
6.0	13.6	-	-	10.5							
6.5	12.4	-	-	9.5							
7.0	10.7	-	-	8.8							
7.5	8.9	-	-	7.8							
8.0	7.6	-	-	7.6	0.4						
8.5	-	-	-	-							
9.0	-	-	-	-							
9.3	lake bottom										

H_2S (ppm) 0.0

EQUIPMENT USED

pH	(P1)	P2	P3	P4	Dis. Oxygen	T1	(T2)	T3	T4	T5	T6
Conductivity	S1	S2	(S3)	S4	Water Temp.	D1	(D2)	D3	D4	D5	D6

Figure A3-1. Lake survey form (back)

Site Card #1, page 1 of 2, outlet of Dennon Lake

SITE CARD

STREAM NAME (gaz.) | Local: Unnamed Creek

WATERSHED CODE: 2 3 7 3 7 5 3 8 9 1 6 5 0 9 0 1 7 1

ILP MAP #: N/A | ILP #: N/A | NID MAP #: N/A | NID #: N/A

REACH #: Unknown | SITE #: 1 | FIELD UTM: 10 518107 6156767 GPS | SITE LG: 4 m, T | ACCESS: FT

DATE: 1 9 9 8 0 7 1 4 | TIME: 1 5 3 0 | AGENCY: COE5 | CREW: RJZ, ARL | FISH FORM: Y (N)

CHANNEL med

CHANNEL WIDTH (m)	T	4.0								
WETTED WIDTH (m)	T	2.0								
RES. POOL DEPTH (m)	T	N/A								

GRADIENT %

W_b Dp (m): 0.4 x 0.15 | STAGE: (L) M H | No Vis. Ch. ☐ Dry Int. ☐ DW ☐ Tribs. ☐

COVER

	COVER Total: Boulder						
Type	SWD	LWD	B	VC	DP	OV	IV
AMT	T	N	N	N	N	A	N
LOC	P	N/A	N/A	N/A	N/A	S	N/A

CROWN CLOSURE: 0 1 2 (3) 4

LWD FNC: (N) F A | DIST: C E

INSTREAM VEG: N A (M)

LB SHP: U V (S) O | RB SHP: U (V) S O

TEXTURE: LB (F) (G) C B R A | RB (F) (C) C B R A

RIP VEG.: N G (S) C D (M) W | RB N G (S) C D (M) W

STAGE: INIT SHR PS YF (M) SNA | STAGE: INIT SHR PS YF (M) SNA

WATER

EMS: Up-Telemetered | REG. #: N/A

TEMP: [illegible] °C | COND.: N/A µS/cm

pH: 2.9 | TURB.: T M L (C)

FLD SNS: 0.9m / Horizontal section of channel

BED MATERIAL: Dominant C | Subdom. G

D95 (cm): 20 | D (cm): 1.0 | Morph.: RP

MORPHOLOGY

DISTURBANCE INDICATORS: O1 B1 B2 B3 D1 D2 D3 | C1 C2 C3 C4 C5 S1 S2 S3 S4 S5

PATTERN: TM ME (IM) IR SI ST

ISLANDS: (N) O I F S AN

BARS: (N) SIDE DIAG MID SPAN BR

COUPLING: DC PC (CO)

CONFINEMENT: EN CO FC (OC) UN N/A

FEATURES

C	NID MAP #	NID #	TYPE	HT/LG (m)	med	PHOTO	COMMENTS	UTM
5	–	–	E	–, –	T	R 9 F 20	Pool Sample Site [illegible]	10 518251 6156[illegible]
5	–	–	E	–, –	T	R 9 F 21	Pool Sample Site [illegible]	10 518[illegible]
6	–	–	BR	–, –	T	R 9 F 18	Road crossing [illegible]	10 518107 6156767
6	–	–	BR	0.5, 0.3	T	R 9 F 19	Road crossing [illegible]	10 518107 6156767
7	–	–	TRB	–, –	T	R 9 F 19	Looking [illegible]	10 518107 6156767

Figure A3-2. Site card #1 (front)

Site Card #1, Page 2 of 2, Outlet of Duncan Lake

HABITAT QUALITY

Lake is barren, rock intrudes in parts but suitable for fall spawning but not
for summer as rainbow trout could release eggs but would spawning gravel. Stream
normally has very sparse spawning but in the event Texas Creek is blocked could
be. Rearing for fry and parr excellent but for trout, observed could be
adult holding habitat at inlet but probably most during spawning. Substrate
particles 1 cm to moderate size rock depth 0.5 m. Velocity is slow to moderate

FSC =

PHOTO DOCUMENTATION

ROLL #	#	FOC LG	DIR	COMMENTS
See	Page	#1		

WILDLIFE

GROUP	WILDLIFE OBSERVATIONS	GROUP	WILDLIFE OBSERVATIONS
INV	Caddisfly	BIR	Common Merganser, Mallards
BIR	Dippers	MAM	Squirrel & Grouse

COMMENTS

C		C	
1	Deposited vegetation or streamside cover in	R	Velocity: Slow to Swift
2	No LWD Present in Site		Length: 40m, Width: 8m, Depth:
3	No disturbance indicators present		Mean Annual: 9.0m³/s, 57.5cfs, Duncan
4	Canopy on right bank		Discharge: 0.00216 m³/s
5	Photo at point looking u/s, d/s, R, L, & Outlet		
6	Photo at reach mouth and end of reach		
7	Photo at each Bend at mouth/outlet only		

Fig-4a A3-2. Site card #1 (back)

Site Card #2 Page 1 of 2. Inlet #1

SITE CARD

STREAM NAME (gaz.) (local) Unnamed Creek

WATERSHED CODE 1703418751531801061551310

LP MAP # N/A | LP # N/A | NID MAP # N/A | NID # N/A

REACH # 2 - | SITE # 1 | FIELD UTM 10 518712 6158446 GPS | SITE LG 215.1 T | ACCESS FT

DATE 19 9 8 0 7 1 5 | TIME 1321 | AGENCY COE 5 | CREW BTS, AKL | FISH FORM Y N

CHANNEL (mm)

CHANNEL WIDTH (m)	T	4.0									
WETTED WIDTH (m)	T	1.5									
RES. POOL DEPTH (m)	T	0.9									
W_D Dp (m)	0.3		T								

GRADIENT % 5.5 6

STAGE (D) M H | No Vis. Ch. = | Dry/Int. = | OW = | Tribs. =

EMS | TEMP 12.0 °C | pH 9.6

REQ. # | COND. N/A µS/cm | TURB. T M (C)

FLO SNS Eroding Slope, Sediment in Pool

BED MATERIAL Dominant C | Subdom. G Gravel

D95 (cm) 23 | D (cm) 5 | Morph. RP

DISTURBANCE INDICATORS: 01 B1 B2 B3 D1 D2 D3 | C1 C2 C3 (C4) C5 S1 S2 S3 S4 (S5)

COVER — Total T

	SWD	LWD	B	UC	OP	OV	IV
Type							
AMT	T	T	S	N	N	T	N
LOC	P	Bnks	Trib	Mdw	Wtr	S	Ash

CROWN CLOSURE: A | SD | SUD | MID | TOP | UP — (1)

PATTERN TM ME IM (IR) SI ST

ISLANDS (N) 0 1 F S AN

BARS (N) SIDE DIAG MID SPAN BR

COUPLING (OC) PC CO

CONFINEMENT EN CO FC OC (UN) NA

INSTREAM VEG N A (M) V

LWD FNC N (F) A DIST C (E)

LB SHP U V (S) O | RB SHP U V (S) O

TEXTURE (F) G C B R A | TEXTURE (F) G (C) B R A

RIP. VEG. N (G) S C D M W | RIP. VEG. N (G) S C D M W

STAGE INIT SHR PS YF (MA) NA | STAGE INIT SHR PS YF (MA) NA

FEATURES

C	NID MAP #	NID #	TYPE	HT / LG (m)	mm	PHOTO	COMMENTS	UTM
1	—	—	—	0.3 / 0.3	T	R 10 F 4	Photo of 1.0m waterfall	10 518555 6158321
2	—	—	—	0.3 / 0.0	T	R 4 F 17	Photo from u/s @ bridge	10 518460 6158763
						R F		
						R F		

Figure A3-3. Site card # 2 (front)

Site Card # 2 Page 1 of 2, Inlet #1

HABITAT QUALITY

This creek has been diverted ≈ 12.5m w/s from the mouth and now has a new channel entering the lake along the north shore. The creek could be re-diverted back to the old channel (dry @ time of survey). Small spawning habitat is present in the old channel which would have to be made at the increase in discharge.

FSZ =

PHOTO DOCUMENTATION

ROLL #	#	FOCUS	DIR	COMMENTS
11	12	40	D/S	Typical boulder substrate in D/S portion of reach
11	2	40	U/S	Typical boulder substrate in U/S portion of reach
11	3	32	D/S	Photo taken from top of right bank looking D/S towards the lake
11	11	28	D/S	Photo taken at old channel ≈ 12.5m w/s from mouth
9	16	30	D/S	Photo taken from bridge looking D/S

WILDLIFE

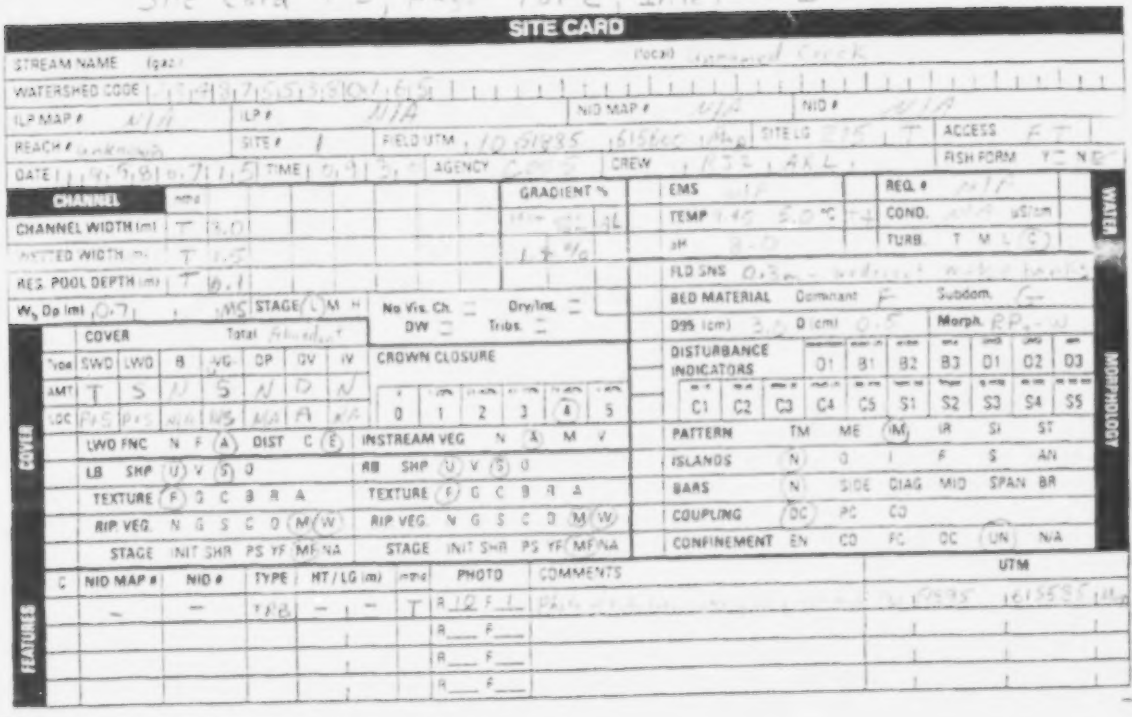
GROUP	WILDLIFE OBSERVATIONS	GROUP	WILDLIFE OBSERVATIONS
Fish	Sculpin [illegible]		

COMMENTS

C		C	
1	Reach break # 1		
2	Bridge was collapse even with weight of road material on top.		

Figure A3-3. Site card # 2 (back)

Site Card #3, Page 1 of 2, Inlet #2



SITE CARD

STREAM NAME (gaz.) (local) unnamed Creek

WATERSHED CODE

ILP MAP # N/A | ILP # N/A | NID MAP # N/A | NID # N/A

REACH # unknown | SITE # 1 | FIELD UTM | SITE LG | ACCESS

DATE | TIME | AGENCY | CREW | FISH FORM Y N

CHANNEL

CHANNEL WIDTH (m) T 3.0

WETTED WIDTH (m) T 1.5

RES. POOL DEPTH (m) T 0.1

W_b Dp (m) 0.7 | WS | STAGE L M H

No Vis. Ch. = Drv/Int. =

DW = Tribs. =

COVER — Total Abundance

	SWD	LWD	B	VG	DP	OV	IV
AMT	T	S	N	S	N	D	N
LOC	FS	PS	NA	NS	NA	A	NA

CROWN CLOSURE

0	1	2	3	4	5

LWD FNC N F (A) DIST C (E)

LB SHP (U) V (S) O

TEXTURE (F) G C B R A

RIP VEG. N G S C D (M) (W)

STAGE INIT SHR PS YF MF NA

INSTREAM VEG N (A) M V

AB SHP (U) V (S) O

TEXTURE (F) G C B R A

RIP VEG. N G S C D (M) (W)

STAGE INIT SHR PS YF MF NA

GRADIENT %

1	1	1

EMS

TEMP 4.5 5.0 °C

pH

FLD SNS 0.3m - bedrock with boulders

BED MATERIAL Dominant F Subdom. G

D95 (cm) 3.0 D (cm) 0.5 Morph. RP-N

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5

PATTERN TM ME (M) IR SI ST

ISLANDS (N) O I F S AN

BARS N SIDE DIAG MID SPAN BR

COUPLING (DC) PC CO

CONFINEMENT EN CO FC OC (UN) N/A

REQ. #

COND. µS/cm

TURB T M L (C)

WATER

MORPHOLOGY

FEATURES

C	NID MAP #	NID #	TYPE	HT / LG (m)	mm	PHOTO	COMMENTS	UTM
	–	–	FAL	– / –	T	R 12 F 1	Falls	10 0935 6155855
						R___ F___		
						R___ F___		
						R___ F___		

Figure A3-4. Site card # 3 (front)

Site Card # 3, Page 2 of 2, Inlet # 2

HABITAT QUALITY

- Lots of Cobble slopes for cover
- Limited Seaweed habitat
- Some good spawning & juvenile habitat
- Creek appears to have originated from the channel located SE to NE of the inlet.
- Substrate was a mix of sand, gravel, cobble and boulders

FS2

PHOTO DOCUMENTATION

ROLL #	#	FOCLG	DIR	COMMENTS
10	3	28	u/s	Point Sample Site #1 looking u/s (creek flowing
10	4	28	d/s	Point Sample Site #1 looking d/s (Sample Tape
10	13	70	u/s	Photo at mouth of inlet (at the point of Spit)

WILDLIFE

GROUP	WILDLIFE OBSERVATIONS	GROUP	WILDLIFE OBSERVATIONS
BIR	Sparrow		

COMMENTS

C		C	

Figure A3-4. Site Card #3 (back)

Appendix 4. Annotated air photo.

LOCATION OF INVENTORY SITES

Lake:	Doonan
Reference No.:	30BCC97182
	Photo No. 69
Enlarged scale:	1: 4,694

Plate number, area, and direction

Point sample, number, and location

Bench mark location

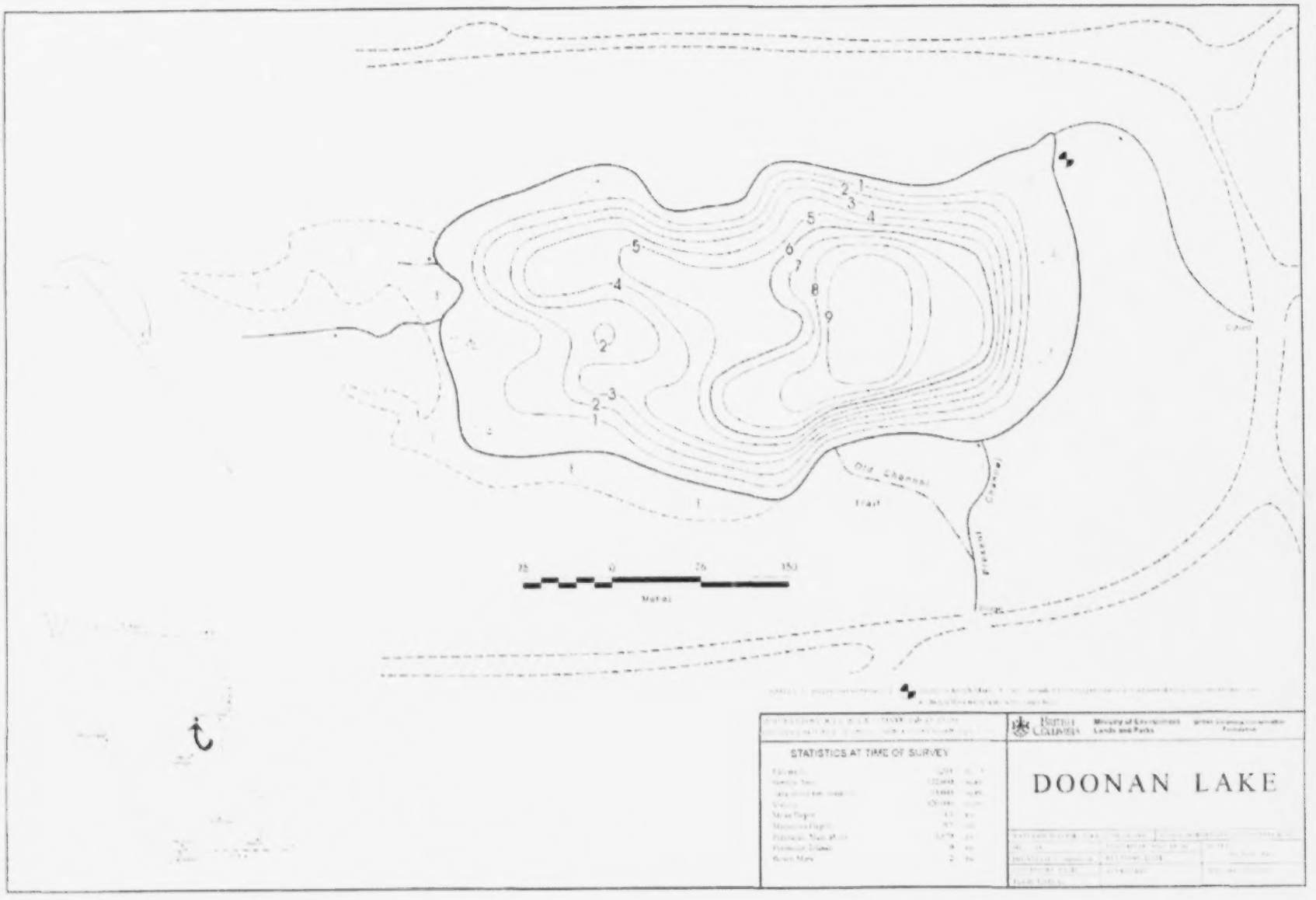
LS 1 Limnology station location

NS 1 Netting site location and number

Minnow trap location and number

Stream flow direction and number

Appendix 5. Bathymetric map.



STATISTICS AT TIME OF SURVEY

DOONAN LAKE

Appendix 6. Lake and stream photos.

PHOTOGRAPH DIRECTORY

Negative #	Plate #	Description
R9:13	1	On the outlet, at the road crossing, taken 30 m u/s from the culvert looking d/s at the creek and two culverts.
R9:17	2	On permanent inlet #1, at the road crossing, taken 10 m d/s of bridge looking u/s of creek and bridge. Note the large logs holding the road material in place.
R9:18	3	Looking at the benchmark located at the outlet. Note the lake drains to the left of this picture.
R9:20	4	On the outlet, at point sample #1, looking u/s.
R10:2	5	On permanent inlet #2, at point sample #1, looking u/s.
R10:12	6	Photo of dominant aquatic vegetation located throughout Doonan Lake.
R10:13	7	On permanent inlet #2, photo of mouth of inlet taken from the lake.
R10:16	8	On Doonan Lake looking at rock escarpment on southwest shore where net set #1 was set.
R10:17 and 18	9	Panoramic view of Doonan Lake taken from the outlet looking southeast.
R11:3	10	On permanent inlet #1, at 10 m u/s from the mouth, looking d/s.
R11:11	11	On permanent inlet #1, at 40 m u/s from the mouth of the remnant dry channel looking d/s.
R11:13	12	On permanent inlet #1, at point sample #1, looking d/s.
R11:18	13	Photo of natural underwater spring located at the northeast shore.
R11:21	14	Photo of Doonan Lake taken from the limnology station looking northwest.

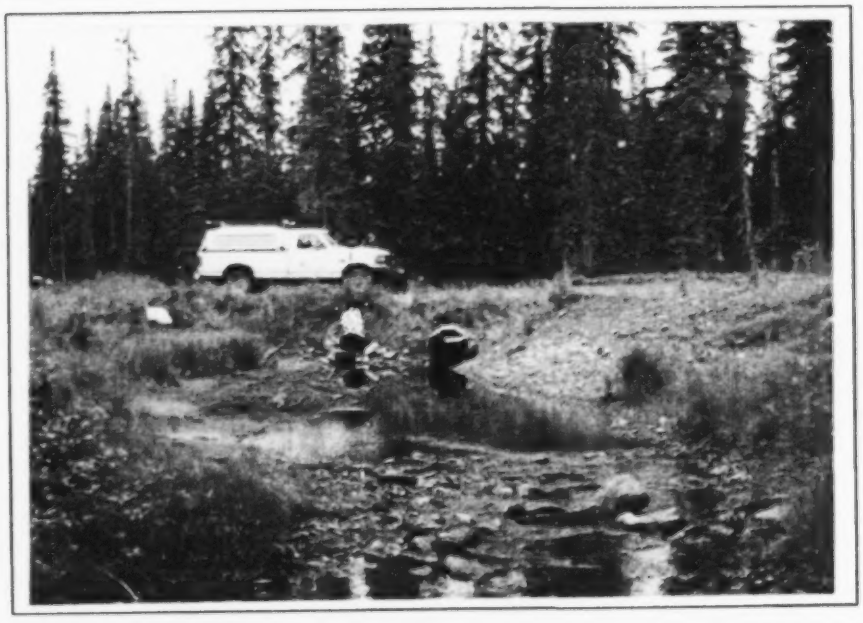


Plate 1: On the outlet, at the road crossing, taken 30 m u/s from the culvert looking d/s at the creek and two culverts.

Plate 2: On permanent inlet #1, at the road crossing, taken 10 m d/s of bridge looking u/s of creek and bridge. Note the large logs holding the road material in place.

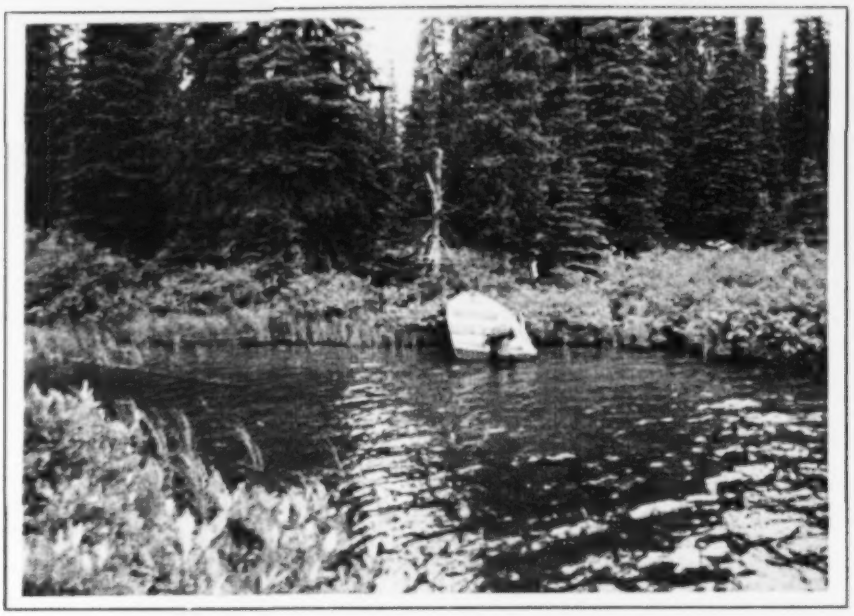


Plate 3: Looking at the benchmark located at the outlet. Note the lake drains to the left of this picture.

Plate 4: On the outlet, at point sample #1, looking u/s.

Plate 5: On permanent inlet #2, at point sample #1, looking u/s.

Plate 6: Photo of dominant aquatic vegetation located throughout the lake.

Plate 7: On permanent inlet #2, photo of mouth of inlet taken from the lake.

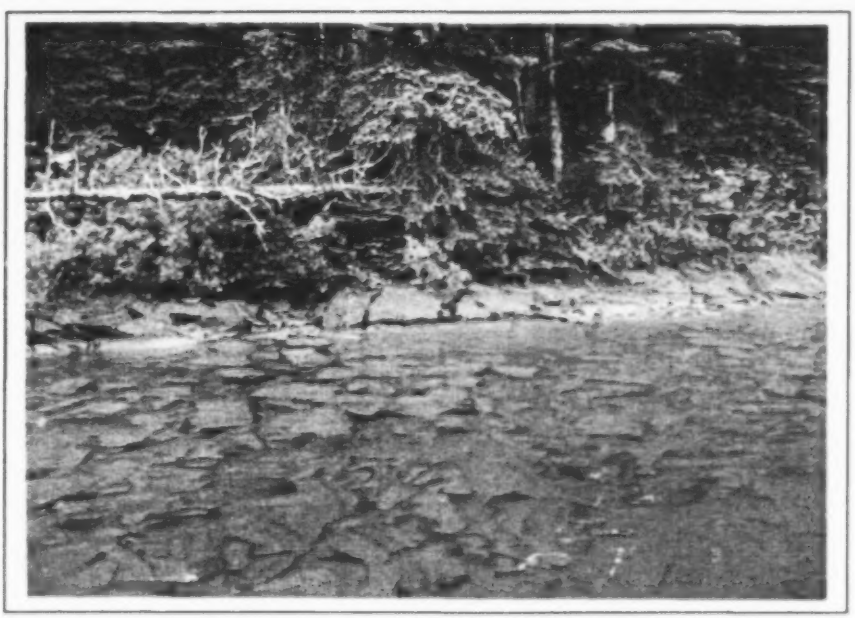


Plate 8: On Doonan Lake looking at rock escarpment on southwest shore where net set #1 was set.

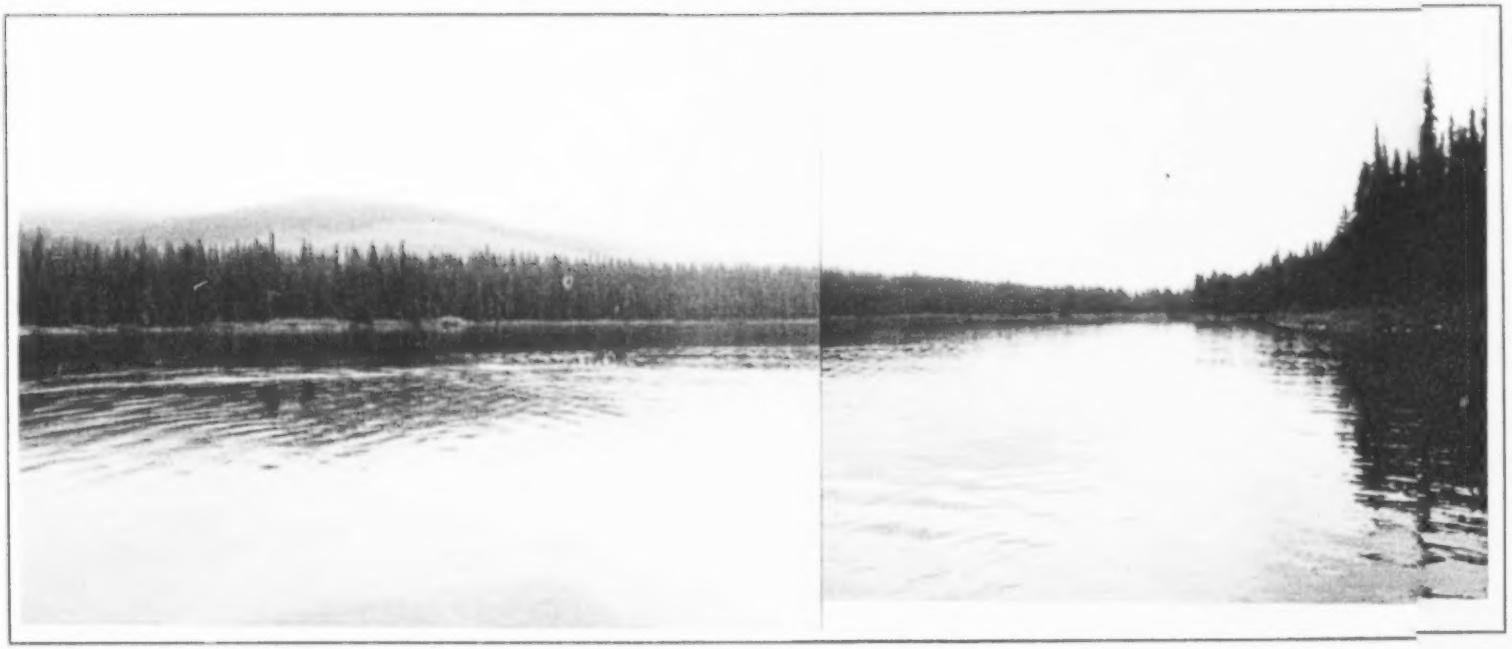


Plate: 9 Panoramic view of Doonan Lake taken from the outlet looking southwest.

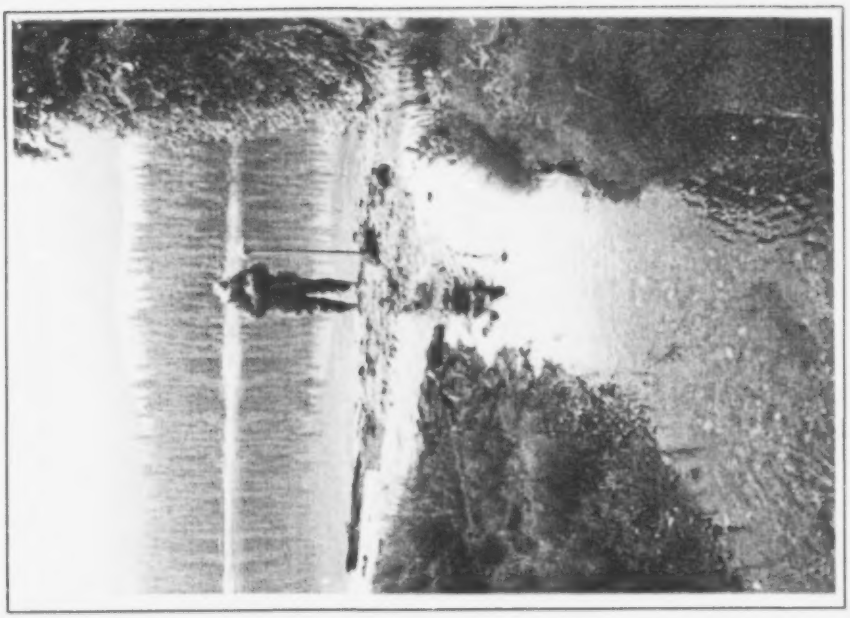


Plate 10: On permanent inlet #1, at 10 m u/s from the mouth, looking d/s.

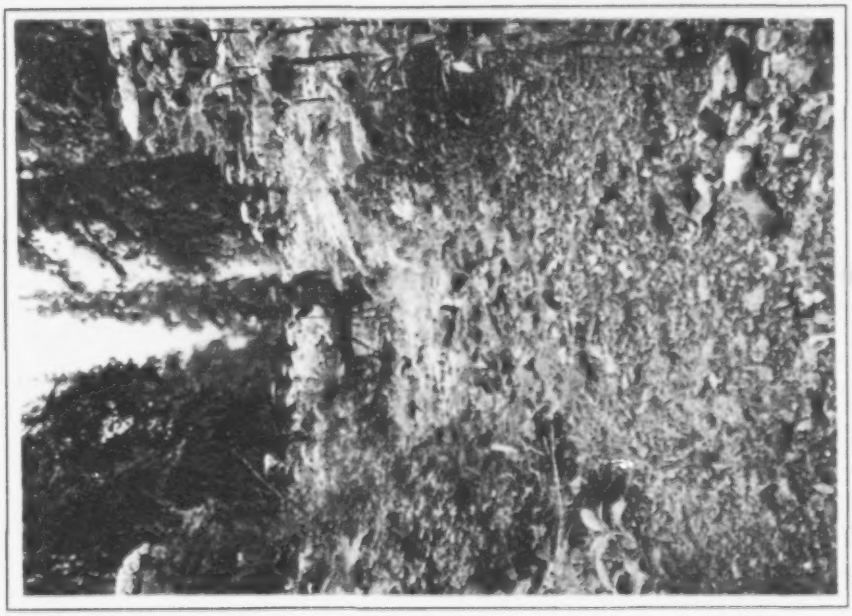


Plate 11: On permanent inlet #1, at 40 m u/s from the mouth of the remnant dry channel looking d/s.

Plate:12 On permanent inlet #1, at point sample #1, looking d/s.

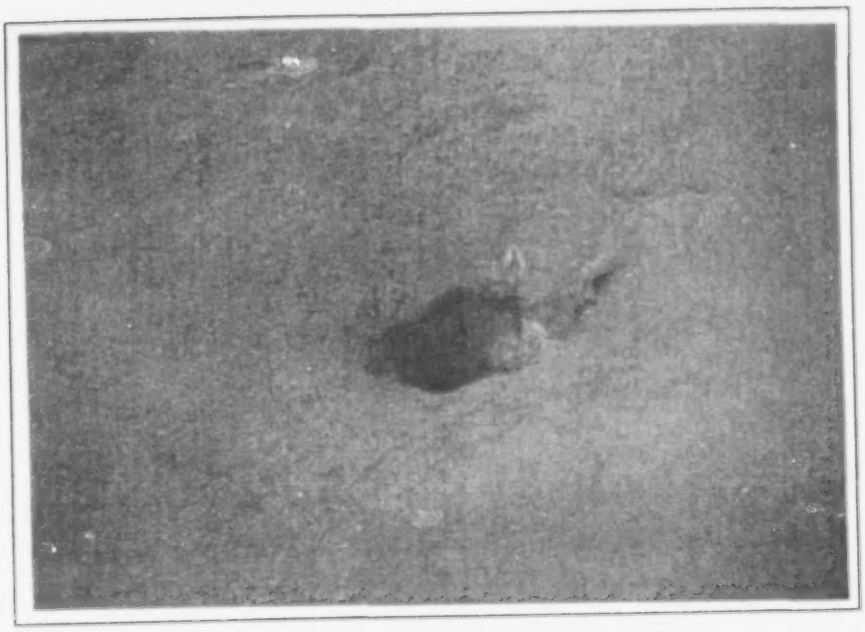


Plate 13: Photo of natural underwater spring located at the northwest shore.

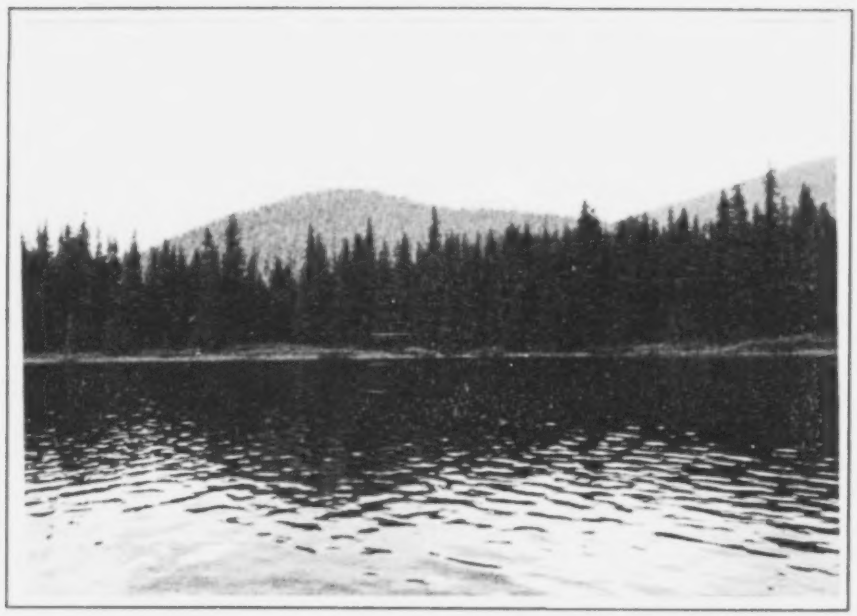


Plate 14: Photo of Doonan Lake taken from the limnology station looking northwest.

Appendix 7. Summer water chemistry data (General and Metals), July 15, 1998.

Environment Canada -Laboratories
Pacific Environmental Science Centre
2645 Dollarton Hwy.
North Vancouver, B.C.
V7H 1V2 (604)924-2500

Lab Reference #
9 8 4 3 1 7

00:06 12-Sep-98

F I N A L R E P O R T

Identification: UNNAMED CK NR DOONAN CK ZEMLAK,RANDY

Type of Sample: Fresh Water (General)

Submitted by: YEE,STEWART
PESC SC.SUPPORT
SCIENTIFIC SUPP
PESC
ENV CONSERVATION

Submission RefId: 50013683

Logged in: 17-Jul-98 (3 samples)

Completed: 11-Sep-98 (57 results)

Charged to: 99-900
PESC - DIRECT BILLING

Analyzed for: INORGANICS, FIELD DATA

Authorized by: _____
Richard Strub
QA Officer

RESULTS FOR UNNAMED CK NR DOONAN CK ZEMLAK, RANDY SAMPLES

Parameter Analyzed	Units	SURFACE 984317-001	MIDDLE 984317-002	1.0M ABV BOTTOM 984317-003
ACIDITY	mg/l	<1.	<1.	1
ACIDITY/PH 4.5	mg/l	<1	<1	<1
ALKALINITY	mg/l	105	104	134
CONDUCTIVITY	uS/cm	192	190	242
NITROGEN/AMMONIA	mg/l	<.005	.007	.014
/NITRITE	mg/l	<.002	<.002	<.002
/NITRITE+NITRATE	mg/l	.004	<.002	<.002
/TOTAL	mg/l	.27	.13	.16
PH	Rel.U.	8.37	8.35	7.86
PHOSPHORUS/TOTAL	mg/l	<.002	.003	0.011
/TOTAL DISSOLVED	mg/l	.003	.008	0.005
RESIDUE/FILTERABLE	mg/l	110	100	140
BC SAMPLING AGENCY	EMScode	70	-	-
SITE IDENTIFIER/NUMBER		E232783	-	-
COLLECTION START DATE	y/m/d	98/07/15	-	-
TIME	hhmm	1510	1522	1526
UPPER DEPTH	metres	0.5	4	8
TEMPERATURE ON ARRIVAL	deg.C	10	-	-

SUMMARY FOR UNNAMED CK NR DOONAN CK ZEMLAK, RANDY SAMPLES

Test Code	Description	Qty		Charge
ACID	ACIDITY	* 3		$36.00
ACID45	ACIDITY/PH 4.5	* 3	=	$36.00
ALK	ALKALINITY	* 3	=	$36.00
COND	CONDUCITVITY	* 3	=	$13.50
NH3	NITROGEN/AMMONIA	* 3	=	$40.50
N02	NITROGEN/NITRITE	* 3	=	$31.50
N023	NITROGEN/NITRITE+NITRATE	* 3	=	$31.50
TN	NITROGEN/TOTAL	* 3	=	$72.00
PH	PH	* 3	=	$13.50
TP	PHOSPHORUS/TOTAL	* 3	=	$49.50
TDP	PHOSPHORUS/TOTAL DISSOLVED	* 3	=	$49.50
FR	RESIDUE/FILTERABLE	* 3	=	$54.00
		Total charged =		$463.50

Charged to: 99-900 PESC - DIRECT BILLING
[3] External Users (@Prio:N)

Submission RefId: 50013683

Environment Canada -Laboratories
Pacific Environmental Science Centre
2645 Dollarton Hwy.
North Vancouver, B.C.
V7H 1V2 (604)924-2500

Lab Reference #
9 8 4 3 1 8

01:17 06-Aug-98

F I N A L R E P O R T

Identification: UNNAMED CK NR DOONAN CK ZEMLAK,RANDY

Type of Sample: Fresh Water (General)

Submitted by: YEE,STEWART
PESC SC.SUPPORT
SCIENTIFIC SUPP
PESC
ENV CONSERVATION

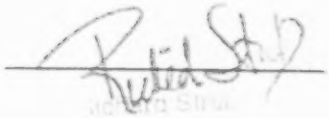
Submission RefId: 50013687

Logged in: 17-Jul-98 (1 sample)

Completed: 05-Aug-98 (35 results)

Charged to: 99-900
PESC - DIRECT BILLING

Analyzed for: METALS, FIELD DATA

Authorized by: 

RESULTS FOR UNNAMED CK NR DOONAN CK ZEMLAK, RANDY SAMPLE

Parameter Analyzed		Units	1984318-001
METALS/TOTAL (WATER-ICP)	AG	mg/l	<.01
	AL	mg/l	<.06
	AS	mg/l	<.06
	B	mg/l	<.01
	BA	mg/l	.03
	BE	mg/l	<.001
	CA	mg/l	32
	CD	mg/l	<.006
	CO	mg/l	<.006
	CR	mg/l	.014
	CU	mg/l	<.006
	FE	mg/l	.056
	K	mg/l	.5
	MG	mg/l	4.4
	MN	mg/l	.004
	MO	mg/l	<.01
	NA	mg/l	<.1
	NI	mg/l	<.02
	P	mg/l	<.1
	PB	mg/l	<.06
	S	mg/l	1.1
	SB	mg/l	<.06
	SE	mg/l	<.06
	SI	mg/l	.83
	SN	mg/l	<.06
	SR	mg/l	.139
	TI	mg/l	<.002
	V	mg/l	<.01
	ZN	mg/l	.045
BC SAMPLING AGENCY		EMScode	70
SITE IDENTIFIER/NUMBER			E232783
COLLECTION START DATE		y/m/d	98/07/15
TIME		hhmm	1510
UPPER DEPTH		metres	0.5

SUMMARY FOR UNNAMED CK NR DOONAN CK ZEMLAK, RANDY SAMPLE

Test Code	Description	Qty	Charge
TOTICP.XW	METALS/TOTAL (WATER-ICP)	* 1 =	$30.00
		Total charged =	$30.00

Charged to: 99-900 PESC - DIRECT BILLING
[3] External Users (@Prio:N)

Submission RefId: 50013687

Appendix 8. Fish sampling details.

NETTING RECORD

Mesh sizes experimental order: 25, 76, 51, 89, 38, 64 mm

NETTING SITE #1

Type:	Sinking monofilament gill net		
Date Set:	July 13, 1998	Time:	1745 hrs
Date Lifted:	July 14, 1998	Time:	1305 hrs
Net Dimensions:	Length: 91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm	Depth: Substrate:	0.7 m bedrock
Deep End Mesh Size:	64 mm	Depth: Substrate:	9.1 m organics black mud

Comments:

Net set in late afternoon, anecdotal information suggested that the lake was barren. Net checked in the morning, no fish. Therefore, net was left in until afternoon before being pulled. Scuds were plentiful in the net once it was finally pulled. Again, no fish captured.

MINNOW TRAPS

Bait: Sardines

#	HOURS	DEPTH (m)	SUBSTRATE	SPECIES	NUMBER	SIZE RANGE (cm)
1	19.0	0.4	organics on rocks	none	0	N/A
2	19.0	0.3	organics on fines	none	0	N/A
3	19.0	0.4	organics and fines	none	0	N/A
4	18.5	0.3	fines	none	0	N/A
5	18.5	0.5	organics and aquatic vegetation	none	0	N/A
6	18.5	0.4	rock outcrop	none	0	N/A

Appendix 9. Tributary description details.

Permanent Inlet #1 (north shore)

- Mouth of inlet, U.T.M. coordinate = 10.518455.6156667, taken from a Trimble Flightmate Pro GPS, (4 satellites received).
- From the mouth walking upstream, the habitat features were:
- At the mouth - the creek enters the lake as 2 small streams (Plate 10). Here, wetted width is 1.0 m, channel width is 4.0 m, average depth is 5 cm, maximum depth is 10 cm, dominant substrate is fines, sub-dominant substrate is small gravel. Used floating chip method to determine discharge, estimated at 0.0095 m^3/sec.
- At 4 m from the mouth - the creek is confined to one channel.
- At 10 m from the mouth - the creek is braided. The stream on the right hand side looking downstream ends 25 m from this point. Above this point, the creek is flowing subterranean (not a tributary to the main channel). No fisheries values here in this channel. The stream on the left hand side is the main channel.
- At 20 m from the mouth - this main channel has some spawning substrate available for salmonids below this point. Above this point is a small 1.0 m waterfall which is a barrier to upstream fish passage. A plunge pool is present and has a depth of 60 cm. This point was recorded as the end of Reach 1. There is no confined channel immediately above this waterfall. Some subterranean flow is present.
- At 80 m from the mouth - there is evidence of sediment transport here. A lot of gravel has moved down from the stream above. The creek has no confined channel below this point. Gravel has accumulated at this location and further upstream during previous high flows. There is evidence of large quantities of gravel/cobble held up by fallen trees.
- At 125 m from the mouth - the creek has been diverted from its natural course. There is an old remnant channel present on the left hand bank. This remnant channel is dry. A lot of bed material (large gravel and small cobble) has moved to this location from further upstream. Bed material $D_{(cm)}$ size is approximately 5 cm. The initial 125 m of this stream is a new channel that has developed over the last year or two.
- Walked downstream along the remnant dry channel - distance is roughly 125 m to the lake. This old channel is the original one that shows up on the 1:50,000 NTS map and enters the lake near a point of land (Appendix 5). UTM coordinates for the mouth of this old channel is 10.518575.6156506 (5 satellites received). Walked back upstream of the remnant channel. There is a small amount of water flowing in the first 40 m of the creek.

Above this point, the small amount of water is flowing subterranean. Some gravel is present in this channel (Plate 11). An enhancement could be to re-divert the creek back to the original channel. This task would require large amounts of bank material and excavation to direct the creek into the old channel. This enhancement would only be performed if there were any future fish introductions conducted at Doonan Lake with the goal of creating a self sustaining naturalised population.

-At 155 m from the mouth - (30 m above the creek diversion) a site card (Appendix 3, Figure A3 - 3) was filled out to describe the stream habitat features present (Plate 12). Gradient at this point is 5.6 % and is representative of the channel below this point back to the lake. The location of this sample site is in the original channel above the diversion point. Upstream of this point, the gradient increases (visual observation). Some spawning substrate is present. Fry and juvenile habitat is present. No adult holding areas are present.

-At 215 m from the mouth - is a bridge crossing. In the 60 m immediately downstream of this point, the gradient increases and the size of substrate increases to boulder size. Some step pools are present. The bridge does not appear to be very structurally sound. The bridge is made out of a few large logs (Plate 2) covered with several meters deep with road gravel. If future fish introductions were to be considered, an essential precursor would be to examine the structural design/integrity of this bridge. If the bridge was to collapse, the creek would re-divert again and probably flow unconfined along the forest floor. Large bed movement and siltation of the inlet could result. Above this bridge, the creek was not examined. Although, the left bank has been logged relatively close to the riparian zone. It is possible that with the removal of these trees, there has been a resultant increase in maximum instantaneous discharge. With the increase in water, this may be why the creek has topped its banks and is now entering Doonan Lake in a different location. To re-divert this creek back to its original channel would require a minimum of 6 people working with shovels, axes, and a chainsaw to build up the left bank. In addition, a permit would be required to obtain some large nearby logs to use as bank material.

Permanent Inlet #2 (southeast shore)

- At the mouth - the creek enters as a single channel through a large marsh (Plate 7).
- First 30 m - the creek has no gradient or flow at the time of survey. There is 100 % crown closure composed of shrubs and willow species. The average depth is 60 cm and the average width is 1.5 m.
- At 40 m from the mouth - there are some deeper pools present (up to 70 cm). No flow was detectable. Some spawning substrate present.
- At 75 m from the mouth - there is some flow detected here. Crown closure has opened slightly.
- At 140 m from the mouth - a site card (Appendix 3, Figure A3 - 4) was filled out for this area (Plate 5). The creek was walked for another 135 m before this site was chosen as having the most representative site characteristics of the creek.
- At 190 m from the mouth - there is a small tributary that enters on the right bank (looking downstream). The total length of this smaller tributary is 35 m. It goes underground at its headwaters and could be spring fed (Plate ?). The small tributary at this point does have little flow, organic bottom, wetted width of 50 cm, a channel width of 4.5 m, and an average depth of 5 cm. The only fish value here is fry rearing.
- At 230 m from the mouth - there is a small tributary entering on the left bank (looking downstream). There is no fish access to this small tributary for fish. The small tributary enters the main stream over a clay bank that is 50 cm high. There are no fishery values here in the small tributary.
- At 250 m from the mouth - the main creek goes subterranean in a few areas. The creek contains some isolated pools that show no detectable flow.
- At 275 m from the mouth - the creek starts to meander through the forest stand and the marsh is starting to disappear. This was the end of the field survey. At this point, the creek has some adequate fry and rearing habitat. There is not much detectable flow at this point and the creek goes subterranean at times.
- General comments on this creek include: 1) the flows at this point in time (July 15) are not great for fish use but during spring time, they could be more adequate, 2) this creek's upper reaches pass through a clear cut and crosses a road located approximately one km northeast from the lake 3) the creek has adequate fry and juvenile habitat and adult habitat is limited to spawning only, and 4) a few unidentified aquatic insects were present in the creek (including caddis flies).

Outlet (northwest shore)

- At the mouth - there is flow. Habitat characteristics are: wetted width of 1.5 m, channel width of 50 m, substrate is dominated by fines with some gravel and a few boulders, and the banks are covered in moss.
- Walked downstream to road crossing. Total distance from mouth of outlet to road crossing is 413 m.
- At the road culvert - the stream had a wetted width of 2.0 m, a channel with of 10.0 m, and an average depth of 10 cm (Plate 1). The culvert here has a 30 cm vertical waterfall drop at the exit. Just below this site (4 m downstream) is another small waterfall (0.5 m). The culvert and 0.5 m waterfall represent areas of difficult upstream fish passage. This location is the first reach break downstream of Doonan Lake. A point sample site (Appendix 3, Figure A3 - 2) was selected 240 m (upstream from the culvert) or 173 m (downstream from the lake), to record the stream habitat features (Plate 4).
- General comments for this creek include: 1) spawning substrate is sparse, 2) excellent fry and juvenile rearing habitat present, 3) caddis flies present, 4) adult holding habitat is limiting but during spring time, it should improve with the increased discharge, 5) substrate compaction is low to moderate, 6) dominant substrate is small angular cobble while subdominant is large angular gravel, 7) there are a few de-watered braids present, 8) gradient and velocity is suitable for spawning salmonids, and 9) an enhancement potential for this creek would be to add appropriate sized substrate for spawning gravel if future fish introductions were to take place.

Intermittent Inlet #1 (south shore)

- This inlet is quite small and enters Doonan Lake as one channel. The creek was only surveyed in the first 20 m from the mouth. Stream characteristics include: some flow detected, wetted width of 20 cm, channel width of 1.0 m, mean depth of 1.0 cm, substrate consisting of organics, and very low gradient. The inlet does not afford any fishery values. It appears that this stream originates from the large marsh to the southeast. No site card was used to record the habitat feature of this stream.

Natural Underwater Spring (southeast shore)

- There is a spring entering Doonan Lake near the southeast shore (Plate 13). The spring is located approximately 20 m from the shoreline. At this point, there is a small crater like depression in the lake bottom which measures 3 m by 2 m in size. The surrounding water depth is 40 cm. The maximum depth of the crater is 1.0 m. Within the center of this crater is a 30 cm diameter hole. Within this hole is a smaller hole (10 cm diameter). An oxygen/temperature meter was used to verify if this hole was indeed a natural spring.

The probe was hung 0.5 m below the surface of the water within the crater and the water temperature was 14.9° C. The probe was lowered to 1.5 m below the surface (almost within the first hole) and the temperature was 2.8° C.